

Flexible Radiator (FlexRAD), Phase I

Completed Technology Project (2018 - 2019)



Project Introduction

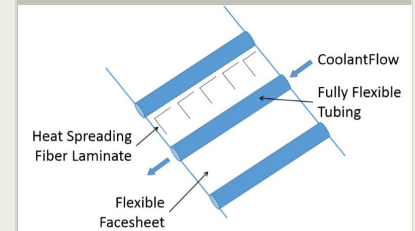
Paragon proposes development of Flexible Radiator (FlexRAD) technology for integration with inflatable habitats. A pumped fluid loop radiator is composed of the fluid loop tubing which carries coolant for heat exchange, facesheets which provide extended surface area for radiative heat rejection, and inlet and outlet manifolds to connect individual sets of tubing. For a radiator to be functional materials and manufacturing methods must efficiently support heat transfer via convection with the coolant, conductive heat transfer through the facesheet, and radiative properties that allow for heat rejection while preventing insulated surfaces from absorbing too much energy. FlexRAD is a system where rigid components are replaced with flexible soft goods to create a radiator that will fully integrate with existing inflatable structures and takes advantage of the full range of benefits afforded by flexible structure.

FlexRAD provides a flexible radiator solution that will be able to balance thermal and structural performance while providing unique deployment capability. FlexRAD will provide a net mass and cost savings compared to traditional radiators because FlexRAD will launch in a stowed configuration not subject to launch accelerations and vibro-acoustics, reducing the amount of supporting structure needed for launch. In addition to easy integration with inflatable habitats, FlexRAD offers improved opportunities to take advantage of multifunctional system integration (e.g., adding Micro-Meteoroid and Orbital Debris protection). FlexRAD is expected to thermal performance on par with existing aluminum radiators, including achieving a fin efficiency of 0.85 and radiative optical properties consistent with current state of the art.

Anticipated Benefits

The FlexRAD target market for space applications is long duration human spaceflight exploration missions and other spacecraft using a single loop ATCS. Fully realized, FlexRAD can be integrated into near-term NASA and commercial human space exploration missions of LEO, the Moon, the Deep Space Gateway, Mars, and beyond. FlexRAD can be optimized for gravity-based surface habitats or microgravity transit vehicles.

The top vendors in the global space habitat market include Bigelow Aerospace, Boeing, Lockheed Martin, NanoRacks, Orbital ATK, SNC, and ULA. Potential commercial NASA customers for FlexRAD technology includes these vendors plus smaller entities such as AXIOM. Paragon already has relationships in place with these companies. SNC and ULA have expressed interest in FlexRAD and provided letters of support for Paragon's development efforts that can be provided upon NASA request.



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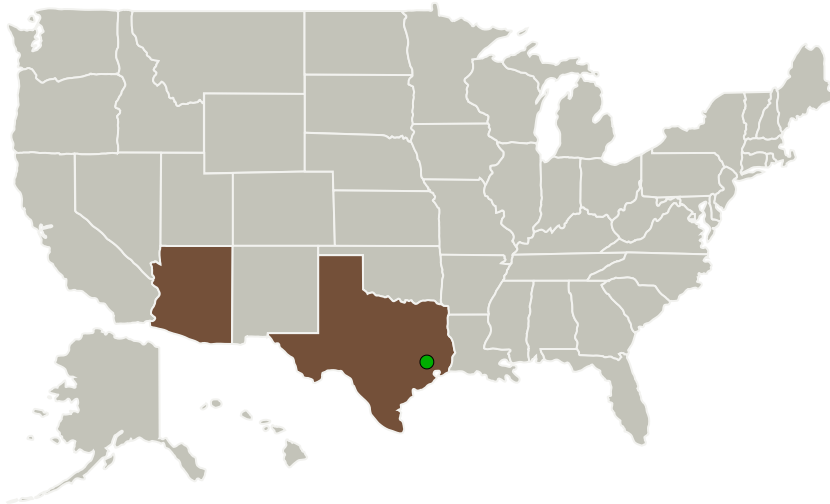
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Paragon Space Development Corporation	Lead Organization	Industry	Tucson, Arizona
● Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations

Arizona	Texas
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Project Transitions

**July 2018:** Project Start**February 2019:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/141348>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Paragon Space Development Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

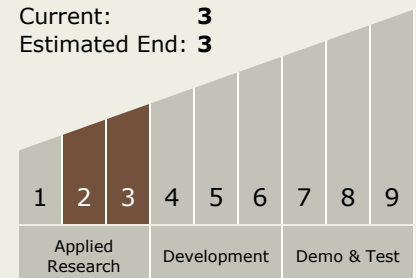
Program Manager:

Carlos Torrez

Principal Investigator:

Chad E Bower

Technology Maturity (TRL)

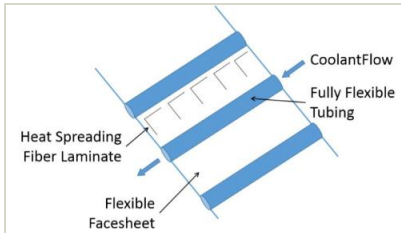
Start: **2**Current: **3**Estimated End: **3**

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Images



Briefing Chart Image

Flexible Radiator (FlexRAD), Phase I
(<https://techport.nasa.gov/image/127078>)



Final Summary Chart Image

Flexible Radiator (FlexRAD), Phase I
(<https://techport.nasa.gov/image/129421>)

Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.2 Thermal Control Components and Systems
 - └ TX14.2.3 Heat Rejection and Storage

Target Destinations

Earth, The Moon, Mars